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DIVISION OF MINES AND GEOLOGY
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May 20,1998

Mr. Ronnie L. Fong
Senior Civil Engineer
City of Fremont
39550 Liberty Street
P.O. Box 5006
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RE: Mapping and Observations at Mission Peak Landslide by Division of Mines and Geology

Dear Mr. Fong:

On April 7, 1998, in response to a request for assistance by the City of Fremont, the Governor's Office of Emergency Services (OES) authorized the Department of Conservation's Division of Mines and Geology (DMG) to assist the City's geotechnical consultant (Dave Rogers) in the mapping of geomorphic features on the Mission Peak landslide, which began moving the last week of March 1998. The OES Mission number for this work is #98-CST7267.

FIELD WORK AND OBSERVATIONS

Due to the very large size and complexity of the landslide, a preliminary geologic investigation was done by Rogers to determine the extent of the hazard posed by the slide. Part of this preliminary investigation included detailed mapping of geomorphic features such as cracks, pressure ridges, and back thrusts, to better define how the slide was moving and to predict future slide movements. On Thursday, May 7th DMG personnel Chuck Real, Tim McCrink, and John Schlosser attended an informational meeting at the City of Fremont. The purpose of the meeting was to update Federal Emergency Management Agency (FEMA) personnel about the preliminary results of the landslide investigation by Rogers. Part of the day was spent in the field observing slide conditions and features that had been discussed earlier during the office presentation. On May 8, 9, and 10, Schlosser of DMG performed detailed geomorphic mapping in the toe area of the slide and assisted Rogers in flagging tension cracks and taking joint and bedding attitudes in the head area.

GEOLOGIC CONDITIONS AND DISCUSSION

Mission Peak Ridge is underlain by upper Miocene marine sediments of the San Pablo group described as sandstone conglomerate and claystone by Thomas H. Rogers (1966). Much of the steep headscarp area of the slide is underlain by bedrock. The slide is approximately 4,000 feet long, 1,000 feet wide and is estimated to be several hundred feet deep in the center and 40 to 70 feet deep in the toe area. Various component parts within the main body of the slide have moved as rotational slides, translational slides, block glides, earthflows and debris flows (Schlosser, J.P., 1998). The Mission Fault trends northwesterly through the upper part of the slide. It crosses the slide a few hundred feet downslope from the headscarp, and is denoted on the ground by the change in soil color from tan to dark gray downslope of the fault.

According to Dave Rogers (verbal communication), the landslide is a composite of many interacting parts or blocks. The initial failure occurred in the upper part; approximately the upper third to half of the slide is now in an active mode of failure. As the upper part moves downslope, blocks in the lower part react to the increased load and pressure and begin readjusting, putting increased pressure on adjacent blocks farther downslope. Movement in the lower half of the slide complex has been much less than the upper part, however, it has still been substantial in certain locations. At the toe of the slide, adjacent to the Mei's house (see location 1 on Figure 1), slide movement is deflected abruptly to the right (to the west). Rogers attributes this abrupt change in direction of movement to a pre-existing zone of weakness, perhaps a fault, located approximately 100 feet north of the Mei's house. Aliso Creek runs along this zone of weakness. The location of the creek and other geomorphic features strongly suggest that the last time this landslide failed, it moved in a similar fashion, changing the direction of movement to the west along this same zone of weakness.

The zone of weakness also defines the boundary between a landslide block to the north of Aliso Creek, that is presently experiencing moderate movement, and a block to the south of the creek on which the Mei's house sits. An inclinometer installed near the Mei's garage indicates approximately 16 inches of lateral movement between early April and May at a depth of approximately 40 feet on the southern block.

Schlosser's mapping of slide features in the toe area (see Figure 2) included careful recording on a large scale topographic base map of the location and azimuth of linear features such as cracks, backthrusts, and toe thrusts. The mapping will help Rogers analyze conditions in the toe area and determine what is going on in the landslide block to the north of Aliso Creek and what the effects will be on the block to the south that supports the Mei's house.

As the pressure on the downslope blocks increases, the effects of readjustment begin to appear in the form of bulges and cracks in front of the more active part of the slide complex. Part of the field mapping on May 8th and 9th involved searching for evidence of newly formed features in the grass and brush along the south and west flank of the slide toe. A recently formed toe bulge/thrust was mapped by Schlosser along the west flank, on the former Hammer property and extending northeastward (see location 2 on Figure 1). Reconnaissance mapping also confirmed substantial movement of the slide toe into the channel of Aliso Creek to the west of the Mei's property.

Rogers discovered, and has been monitoring, incipient failure of a large wedge of rock above the head of the landslide from the steep slopes of Mission Peak Ridge. Much of May 9th was spent flagging tension cracks and the margins of grabens that are opening up within this rock wedge. Numerous attitudes were measured on joint planes and bedding at various places on and adjacent to the wedge failure. Some relatively small failures of this rock slope have already occurred, loading the head of the landslide complex. Based on previous monitoring of cracks and information gathered on May 9th, it appears likely that considerably more rock will fail onto the head of the landslide, causing additional slide movement farther downslope. Rogers determined that the basal failure plane for the large wedge does not daylight on the rock face above the slide mass, but rather projects below the surface of the slide mass, so that catastrophic failure of the entire rock wedge all at one time appears unlikely. It is difficult, however, to predict when the rock slope will fail, how much will fail at any given time, and how it will affect the amount of movement on slide blocks farther downslope. We also observed on May 9th that the landslide headscarp in the area to the south of the incipient rock wedge failure has enlarged from just a few feet high to approximately 12-15 feet in height, as observed at the end of April.

Rogers reported at the May 7th meeting that a debris slide/debris torrent hazard exists, due to the presence of extensive amounts of disrupted soil and rock debris on over steepened slopes, with access to Aliso Creek. The steep slopes exist along the toe thrusts of several blocks within the slide complex and also on two large earthflows present on the upper part of the slide complex. The Aliso Creek channel near the Mei's house has been raised by slide movement, so that the channel now is higher than the Mei's property. A wide, flat area has been formed right at the location where the channel makes a sharp westward bend. Rogers pointed out that sediment has been settling out in the flat area at the bend since the slide started movement, and it will continue to be a place where sediment accumulates. The sharp bend in the creek, together with recent changes in stream channel elevation and gradient due to slide movement, will make it difficult to contain a debris torrent within the Aliso Creek channel, if one occurs. As yet Rogers has not precisely defined the extent of the debris torrent hazard, nor formally identified the houses that could be affected under various scenarios. However, from observations at the site, DMG concurs with his initial assessment that conditions exist that could produce a debris torrent hazard.

CONCLUSIONS

1. DMG field work assistance to the City's consulting geologist is considered to be completed at this time.

2. Given that the rock wedge above the slide mass will likely continue to fail and add weight to the head of the slide, slide movement can be expected to continue longer than would have occurred otherwise. It is likely that slide movement will continue for many months and that the lower portions of the slide will expand in

size and amount of total movement. The exact areas that will be affected, and how much movement will occur in affected areas, is hard to predict and beyond the scope of what DMG was asked to do. Additional monitoring and subsurface investigation will be required in order to develop a more reliable prediction of the area that will be affected.

3. Adverse changes to Aliso Creek channel are likely to continue with the channel being squeezed by movement of the slide toe, with the channel bed being raised by upward movement of the slide toe, and with greatly increased sediment load from streamside slumps and debris slides.

4. Debris torrent occurrences during the next rainy season appear likely, although the volume and the runout distance of the debris torrents cannot be predicted solely on the limited observations of field conditions conducted by DMG personnel thus far. It is our understanding that the City's geologic consultant will make such an assessment of the debris torrent hazard.

References:

Rogers, T.H., 1966, Geologic Map of California, San Jose Sheet: California Division of Mines and Geology, scale 1:250,000.

Schlosser, John, 1998, Initial Report for Mission Peak Slide, City of Fremont, Alameda County, California: Division of Mines and Geology Memorandum to Trinda L. Bedrossian, April 8, 7 p.

John P. Schlosser
Associate Engineering Geologist
RG 4367, CEG 1368

Concur

Date Trinda L. Bedrossian, CEG 1064
Supervising Geologist

Attachment: Location Map

cc: William Cotton
James Davis
Richard Eisner
David Howell (USGS)

FIGURE 7

Location Map of the Mission Peak Landslide – Fremont, California

Shown on base map of 1961 topographic map of the Niles 7½ minute quadrangle, scale 1:24,000. 1 = Mei's House 2 = Hanna Property

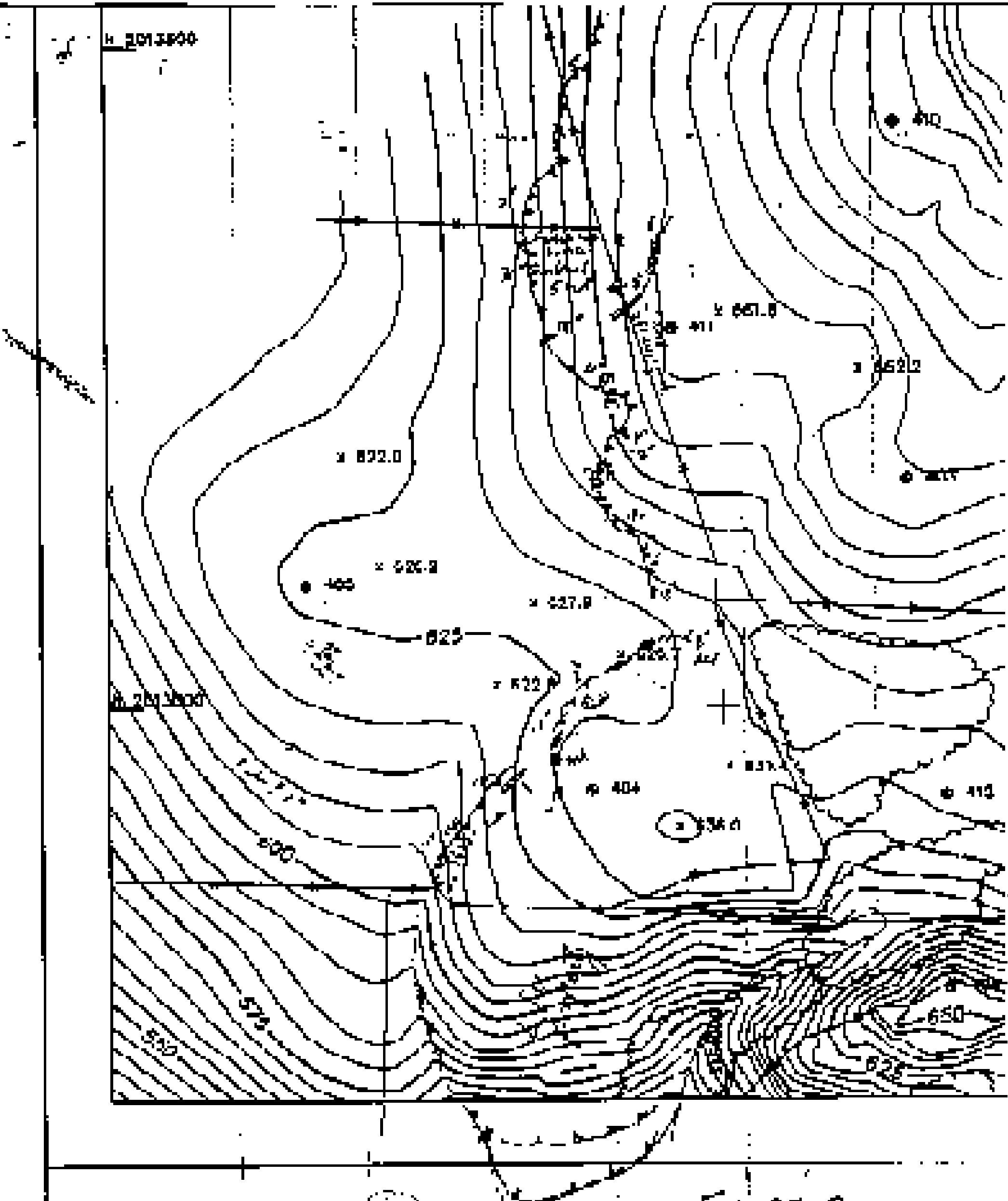

FIGURE-2
(page 1)

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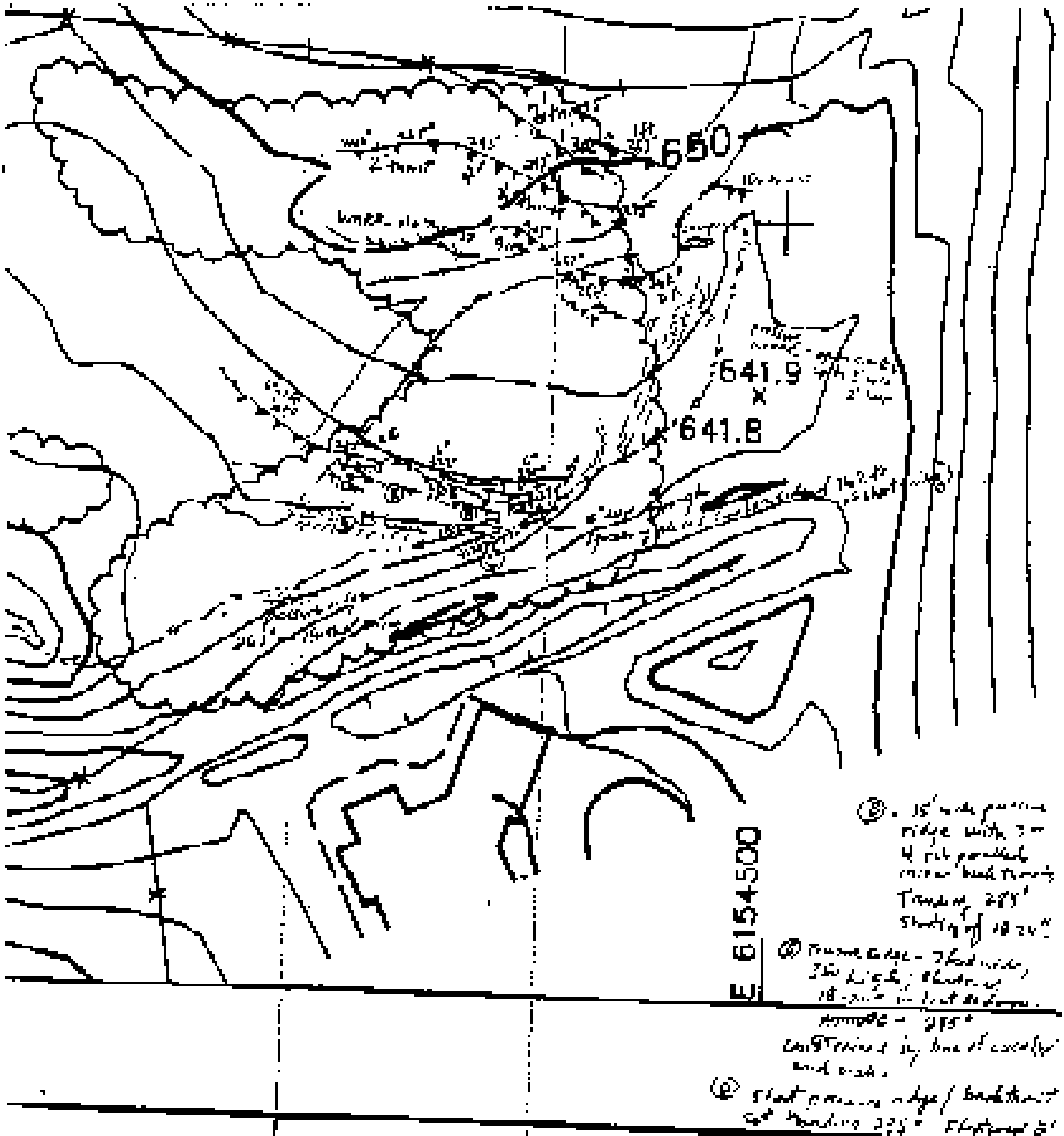


FIGURE-2
(page-1)

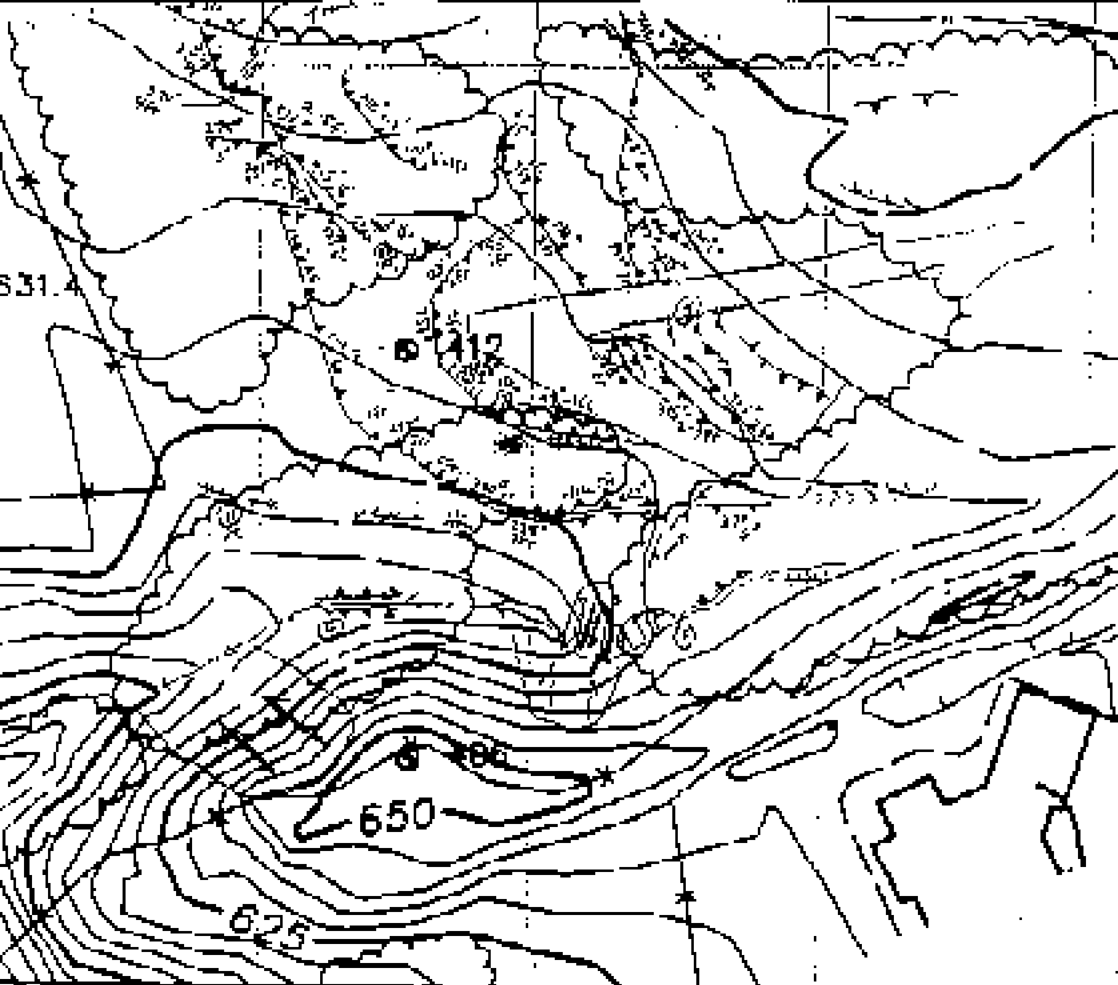
(B). 15' wide pressure ridge with 3 or 4 [illegible] parallel [illegible] thrusts. Trending 285° [illegible]

(D) Pressure ridge - 7 feet wide, 3 ft high; [illegible] trending 285° [illegible]

(E) [illegible] pressure ridge / [illegible] trending 285° [illegible]

(F) [illegible] trough [illegible] trend 276°, 2 1/2 ft deep [illegible]

map was prepared using computer assisted, photogrammetric m
Hammon, Jensen, Wallen & Associates, in Oakland, California,



(J) [illegible]

(H) [illegible]

(G) [illegible]

(F) [illegible]

[illegible]

FIGURE-2
(page 3)

NOTE:

This map was prepared using compute
by Hammon, Jensen, Wallen & Assoc
In areas of dense vegetation, accuracy